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MEMOIRS OF THE GEOLOGICAL SURVEY  
OF  
ENGLAND AND WALES.

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EXPLANATION OF QUARTER-SHEET 88 N.E. OF THE  
GEOLOGICAL MAP OF ENGLAND AND WALES;

ILLUSTRATING

THE GEOLOGY

OF

THE NEIGHBOURHOOD OF DEWSBURY,  
HUDDERSFIELD, AND HALIFAX.

BY

A. H. GREEN, M.A., J. R. DAKYNS, M.A., J. C. WARD, F.G.S.,  
AND R. RUSSELL.

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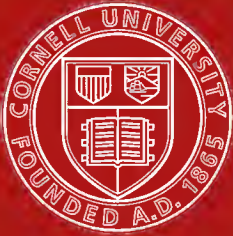
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# GEOLOGY

OF

## THE NEIGHBOURHOOD OF DEWSBURY, HUDDERSFIELD, AND HALIFAX.

THIS pamphlet is intended for nothing more than a short explanation of the main physical and geological features of the country contained in the Quarter-sheet 88 N.E. of the Geological Survey Map of England and Wales. Details will be treated of in a memoir on the Yorkshire Coal Field.

### *Lithological Description of the Rocks.*

With the exception of River-deposits and a few patches of Drift, all the rocks of the district belong to the Carboniferous Formation. They are shown in descending order in the following table.

TABLE of the CARBONIFEROUS ROCKS in 88 N.E.

		Maximum and Minimum Thicknesses.		Average of all Sections obtained.
		ft. in.	ft. in.	ft. in.
MIDDLE COAL MEASURES.	68. HAIGH MOOR COAL	2	11 to 4 0	
	67. Measures with thin Coals			
	66. Sandstone "Thornhill and Dewsbury Rock"			340 0
	65. Measures			
	64. JOAN, MITCHELL, OR PARSON'S COAL	1	3 to 2 3	
	63. Measures	46	0 to 66 0	58 0
	62. { Stone Coal 0'0 to 1'8 } FLOCKTON THICK, OR			
	Coal 0'0 to 1'2 } ADWALTON STONE COAL.			
	Parting 0'1 to 6'0 }			
	Coal 0'10 to 1'2 }			
	61. Measures	24	0 to 67 0	42 0
	60. FLOCKTON THIN, DEWSBURY BANK, YARD, OR ADWALTON BLACK BED COAL.	1	5 to 3 0	
	59. Measures			
	58. Sandstone "Birstall Rock"			
	57. Measures	60	0 to 150 0	100 0
	Coal 0'0 to 2'7 }			
	Parting 1'0 to 29'0 }			
	56. Coal 1'0 to 2'8 } OLD HARDS, DAWGREEN, BROWN METAL, OR TWO YARDS COAL.			
	Measures 0'0 to 25'0 }			
	Coal 0'0 to 1'1 }			
	55. Measures	62	0 to 35 0	68 0
	54. GREEN LANE OR MIDDLETON LITTLE COAL	0	6 to 3 6	
	53. Measures	50	0 to 80 0	64 0
	52. NEW HARDS, YARD, CROMWELL, OR MIDDLETON MAIN COAL.	2	0 to 4 6	
	51. Measures	56	0 to 68 0	60 0
	50. WHEATLEY LIME, THREE QUARTERS, OR MIDDLETON 11 YARDS COAL.	1	0 to 3 0	
	49. Measures	53	0 to 117 0	94 0
	48. BLOCKING, TORTSHAW, OR COOKSON'S COAL	1	3 to 2 4	

		Maximum and Minimum Thicknesses,		Average of all Sections obtained.
		ft.	in.	ft. in.
LOWER COAL MEASURES OF GANISTER BEDS.	47. Measures	72	0 to 99	0
	46. LOUSEY COAL of Whitley and Hopton	0	5 to 2	8
	45. Measures	-	-	78 0
	South. Centre. North.			
	44. { BLACK BAND or LOW LOUSEY COAL 0'10 to 1'8 Measures 30'0 Coal 0'5 to 0'6 Dirt 1'0 Coal 1'2 Shale 4'0 to 24'0 Coal 1'2 } { Coal 1'0 to 2'2 Measures 19'0 to 35'0 Coal 1'6 to 5'0 } { SHEET-CLIFFE, POPPLEWELL STONE, CHURWELL THIN AND THICK COALS. } { BEESTON BED. Coal and Partings 5'0 to 7'0 }	-	-	38 0
	43. Sandstone "Oakenshaw Quarry Stone"	150	0 to 190	0
	42. Measures	0	2 to 2	0
	41. 14 YARDS, THREE COALS BAND, or CROW COAL	23	0 to 42	0
	40. Measures	1	4 to 3	0
	39. IRONSTONE MEASURES	105	0 to 127	0
	38. TINKER COAL or LOW MOOR BLACK BED	1	0 to 2	6
	37. Measures	0	7 to 4	0
	36. COAL, LOW MOOR BETTER BED	10	0 to 80	0
	35. FIRECLAY	210	0 to 130	0
	34. Measures	50	0 to 120	0
	33. Elland Flagstone, sometimes in two or three beds parted by shale.	0	6	
	32. Measures	0	0 to 20	0
	31. 80 YARDS BAND COAL	120	0 to 45	0
	30. 80 Yards Band Rock	0	0 to 1	2
	29. Measures	35	0	
	28. 48 YARDS BAND COAL	0	7 to 1	8
	27. Measures	1	6 to 4	0
	26. 36 YARDS BAND COAL	0	0 to 15	0
	25. FIRECLAY	100	0 to 90	0
	24. 36 Yards Band Rock	2	3	
	23. Measures	30	0	
	22. HALIFAX HARD BED COAL	0	6 to 0	10
	21. Measures	0	0 to 12	0
	20. MIDDLE BAND COAL	60	0 to 35	0
	19. Middle Band Rock	1	6	
	18. Measures	0	0 to 110	0
	17. HALIFAX SOFT BED COAL	80	0 to 30	0
	16. Soft Bed Flags	0	0 to 0	6
	15. Measures	1	0 to 6	6
	14. COAL	108	0	
	13. FIRECLAY	33	0	
MILLSTONE GRIT	12. Rough Rock (Sand Rock of Huddersfield)	153	0	
	11. Flags	127	0	
	10. Shales	78	0	
	9. Sandstone (D.) (White Rock of Huddersfield)	51	0	
	8. Shales	61	0	
	7. Sandstone (C.)	73	0	
	6. Shales	135	0	
	5. Sandstone (B.)	45	0	
	4. Shales	145	0	
	3. Sandstone (A.)	350	0	
	2. Shales			
	1. Kinder Scout Grit			

\* Containing in the south of the district a bed of coarse sandstone, the equivalent of the Grenoside Rock, immediately above the Black Bed Coal.

The Kinder Scout, Grit No. 1, has its usual character, a hard, massive, coarse, and at times conglomeratic grit.

The measures, Nos. 3 to 9, contain four tolerably persistent beds of sandstone, which from their position in the series may be taken as the representatives of the Third Grit of Derbyshire. In the southern part of our district these beds are finely grained, but they become coarser as we go north. Altogether they are very changeable in character. The two beds marked D. and C. often yield a good building stone.

The topmost bed of the Millstone Grit can generally be divided into two bands. The upper, known as the Rough or Sand Rock (No. 12) is a well-marked and persistent coarse grit; the lower is a flagstone

(No. 11) the probable equivalent of the Haslingden Flags of Lancashire. Wherever the latter could be separately traced, it has been coloured green on the map. Both subdivisions are everywhere largely quarried, the upper for building stone, the lower for flags.

Of the coal (No. 14) we have only to notice that, though usually only a few inches thick, it reaches below Elland Station the thickness of 2 feet 4 inches. The fireclay (No. 13) below the coal, reaches in the neighbourhood of Huddersfield a thickness of 6 feet 6 inches and is worked.

The "Soft Bed Flags" (No. 16) are well developed and largely worked in the neighbourhood of Huddersfield.

The "Coking" or "Soft Bed" coal (No. 17) is usually of fair quality and averages 1 foot 6 inches in thickness.

The "Middle Band" coal (No. 19) is a seam of little importance; at Swill Hill, however, it attains the unusual thickness of 2 feet 6 inches.

The "Hard Bed" coal (No. 22), in spite of its inferior quality, is sometimes used for household purposes; its average thickness is 2 feet 3 inches. Beneath it there is generally about one foot of Ganister and from three to six feet of fireclay. In its black shale roof occur *Aviculopecten* and *Goniatites*, and iron calcareous nodules.

The fireclay beneath the "36 yards Band" coal (No. 25) is very generally worked, and ironstone not seldom occurs in connexion with it.

The "48 yards Band" coal (No. 28) is not met with south of the neighbourhood of Halifax. It has been worked at Nab End Colliery, Booth Town, where its thickness was from 10 inches to 1 foot 2 inches.

The "80 yards Band" coal (No. 31) is very variable in its occurrence, though either it or the underlying rock may generally be traced.

The Elland Flagstone (No. 33) is a thick mass of sandstone, flaggy in some parts and thickly bedded in others, often split up into two or three beds by bands of shale. Usually the lowermost sandstone is the most important one. It is largely worked for flags wherever it occurs, and in some parts yields good building stone.

No. 35 is the well known fireclay of Farnley and Wortley. It is used for fire-bricks, tiles, drainage pipes, retorts, and ornamental vases.

The Low Moor Better Bed (No. 36) is, in spite of its small thickness, a very valuable coal on account of its freedom from sulphur and other impurities.\* It is for this reason eminently suited for smelting purposes, and to the use of this coal the excellence of the Low Moor iron is partly due. The first spot coming northwards at which we found this coal worked is about a quarter of a mile south of Fenay Bridge. South of this the coal was seen at one or two places, but seemed to be of poor quality. Still further south the coal disappears, and the bed is represented by its underclay.†

The Low Moor Black Bed or Tinker Coal (No. 38) is worked chiefly as an engine coal, but in some places as an inferior house coal, over nearly the whole of the district. In many of the Farnley Iron Company's pits there are a few inches of inferior cannel, provincially called "Johnnies," at the bottom of the bed.

In the extreme south of our district the Tinker Coal is immediately overlaid by a massive gritty sandstone, the Grenoside and Farnley Tyas Rock of the country still further to the south. (*See Explanation of Quarter-sheet 88 S.E.*, pp. 5 and 8.) This bed, however, thins away rapidly towards the north, and soon disappears altogether. In the shales, which take the place of this sandstone, a band of ironstone measures

\* Iron Ores of Great Britain (Memoirs of the Geological Survey) Part I., p. 31.

† Explanation of Quarter-sheet 88 S.E. (Memoirs of the Geological Survey), pp. 5-8.

(No. 39) makes its appearance. In the southern part of the district these lie about 30 feet above the coal, and are not worked. At Low Moor the ironstone-bearing shale is parted from the coal by a band of clay only a few inches in thickness, and the two are worked together. It is from this bed that the furnaces of Low Moor, Bowling, and Farnley are supplied. The ore is not rich, containing from 28 to 29 per cent. of metallic iron, according to the analysis of "The Iron Ores of Great Britain" (pp. 68 and 70); but from the extreme care taken in cleaning, calcining, and smelting it, the iron produced is, and has long been, distinguished for its excellent quality.

The following is a section of these measures, compiled from numerous sources :—

	ft. in.	ft. in.
Shale and Ironstone: the former contains a great variety of plants, fish-teeth and scales, and the nodules of ironstone contain <i>Anthracosia</i> and <i>Cypris</i> - - -	5	2½ to 10 0½
Ironstone, Top Balls - - -	0	0½ to 0 2
Black shale - - -	0	2 to 0 10
Ironstone, Rough Measure - - -	0	0½ to 0 2½
Black shale - - -	0	5 to 1 2
Ironstone, Flats - - -	0	0¾ to 0 3
Black shale - - -	0	6 to 0 8
Ironstone, Rough Measure - - -	0	0½ to 0 0½
Black shale - - -	0	6 to 0 8
Ironstone, Middle Balls - - -	0	0½ to 0 2
Black shale - - -	0	4 to 1 6
Ironstone, Low Measure - - -	0	0½ to 0 2
Black shale - - -	0	5 to 1 2
Black bed coal.		

The Crow Coal (No. 41) is very regularly found over the whole of the district. South of Shelf Moor it is too thin to be of any value; there it reaches a thickness of 1 ft. 10 ins., and is worked. About Leeds it becomes of very superior quality, and brings a higher price than any other of the coals in the neighbourhood.

The Oakenshaw Quarry Stone (No. 43) is a fairly regular bed. Near Wibsey Slack one of the lower divisions of the rock is pure enough to be ground down and used as moulding sand.

We next come to a very variable group of beds (No. 44), the detailed account of which must be kept for the larger memoir.

The Whinmoor Coal has been traced northwards as far as Hallas, near Kirkburton (in map 88, S. E.), and is very regularly overlaid, at a distance of about 10 yards, by the Black Band; both beds have been largely gotten, chiefly for engine purposes. Northwards from Kirkburton an interval occurs over which we have no information respecting the beds on this horizon, beyond which we find a changeable assemblage of coals corresponding roughly in position with the group under consideration. Still further north two well-marked seams, the Churwell Thin and Thick, are found on this horizon, and these in the end seem to run together and form the Beeston bed.

No. 46. In Whitley Hall Park and at Hopton this bed is about two feet thick, and is worked for local consumption. These, however, are exceptions, the seam being generally thin and worthless.

No. 48. Between Flockton and Dewsbury or Mirfield the following is an average section of this bed :—

	ft. in.	ft. in.
House coal - - -	1	0 to 1 2
Engine coal - - -	0	10

Northwards it gets more divided, until about Robert Town and Gomersall it runs thus :—

			ft. in.	ft. in.
Top coal	-	-	1 0	to 1 2
Shale	-	-	0 1½	to 0 2
Smithy coal	-	-	0 6	
Shale	-	-	0 0	to 0 0½
Bottom coal	-	-	0 5	to 0 8

Further northwards at Tong Moor and Westgate Hill it becomes very much split up by dirt partings. It has been proved by borings at Birstall and West Yorkshire collieries, but not yet worked.

No. 50. The Three Quarters Coal has been worked from Grange Moor to Hartshhead with a thickness of from 1 ft. 6 in. to 3 ft. It is of indifferent quality. Eastwards by Dewsbury and Gomersall it comes down to 1 ft. in thickness, and is finally represented by the Middleton 11 yards, which, as far as we know, has never been worked.

No. 52. As far north as Gomersall this coal, though it shows many local variations, which will be fully described in the larger memoir, may be represented by the following section :—

			ft. in.	ft. in.
Coal	-	-	1 6	to 2 4
Parting	-	-	0 1	to 0 3
Coal	-	-	0 8	to 0 9

At College Colliery, Birstall, and Sunny Bank Colliery, Adwalton, the bottom bed becomes a cannel, and thickens out to 1 ft 7 in.

In the district where the coal is known as the Middleton Bed, the following is an average section of it :—

			ft. in.	ft. in.
Good house coal	-	-	1 6	} to 2 3
Engine coal	-	-	0 6	
Parting	-	-	0 1	to 0 3
Smithy coal	-	-	0 5	to 0 7
Parting	-	-	0 1	
Low coal, often pyritous	-	-	0 9	to 0 11

No. 54. This is a coal of very inferior quality and very variable thickness over the greater part of our district. At Morley Main and Dean Hall Collieries it improves very much, and is worked under the name of the Middleton Little. The following is the section at Morley Main :—

			ft. in.	ft. in.
Top coal ; engine coal	-	-	0 6	to 0 10
Hard coal ; used for locomotives	-	-	0 6	
Bottom coal ; gas coal	-	-	1 6	to 1 8

No. 56. Of this group, which may be called the Brown Metal series, we find one or more of the coal beds always present. The middle coal is probably the most persistent, and is the one known as the Old Hards about Grange Moor, Flockton, and Emroyd.

The Birstall Rock (No. 58) is a massive, finely and closely grained, white sandstone, yielding a good building stone, and largely sawn up into flags. About Birstall it reaches a thickness of 100 feet.

The Flockton Thin Coal (No. 60) about Overton and Thornhill is an excellent house coal, averaging 1 ft. 8 in. in thickness. Northwards it increases in thickness, and falls off a little in quality : thus near Dewsbury it is from 2 ft. 2 in. to 2 ft. 3 in. thick, a good house coal, and was stated to yield 11,000 cubic feet of gas to the ton. About Batley, White Lee, and Adwalton, the average section is :—

			ft. in.	ft. in.
Coal	-	-	0 3	to 0 4
Parting	-	-	0 1	to 0 8
Coal	-	-	2 0	to 2 9

No. 62. The average section of this coal in the neighbourhood of Flockton and Overton is:—

			ft. in.	ft. in.
Coal	-	-	1 0	to 1 6
Parting	-	-	1 3	to 2 2
Coal	-	-	0 11	to 1 2

From Bristfield northwards a portion of the upper bed becomes cannel, the average section being:—

			ft. in.	ft. in.
Stone or cannel coal	-	-	0 10	to 1 0
Coal	-	-	0 0	to 1 2
Parting	-	-	0 1½	to 6 0
Coal	-	-	1 0	to 1 6

Ironstone Measures, known about Sheffield and Barnsley as the "Tankersley Mine," and hereabouts as the "Cockle Shell Bed," lie above the last coal. From the traces of old workings they seem to have been at one time largely gotten, but at present they are worked only at the West Ardsley Colliery. The stone is remarkable from the immense number of *Anthracosia* which it contains.

The Joan Coal (No. 64) varies from 1 ft. 9 in. to 2 ft. 3 in. about Overton, Thornhill, and Dewsbury, Northwards it comes down to 1 ft.

No. 66. This, which is the thickest and most conspicuous rock in the Middle Coal measures of the district, is largely quarried as a building stone, and near Morley is sawn up into excellent flags.

The Haigh Moor Coal (No. 68) is worked at Spothill, where there is the following section:—

			ft. in.	ft. in.
Top coal	-	-	0 9	
Parting	-	-	0 1½	
Coal	-	-	1 0	
Parting	-	-	0 0½	
Coal	-	-	1 0	to 1 2

It makes a good engine coal, but requires careful cleaning for household purposes.

### *Physical Features and Geological Structure.*

The country under consideration is marked out by its physical features into three divisions, which coincide with the areas occupied by the Millstone Grit, the Lower Coal Measures, and the Middle Coal Measures respectively.

The general dip over the greater part of the map is to the north of east, the average strike being well shown by the bold escarpments marking the outcrops of the Rough Rock and the Elland Flagstone. In the north-eastern part of the district the dip changes to a south-easterly direction, and the beds begin to bend round to the east and west strike, which further to the east they in the end assume.

The country lies on the eastern slope of the Penine range, and the drainage is wholly to the east. Nearly the whole of it passes into the Calder, but a small tract on the north-east is drained into the Aire. As is so often the case, the water-parting between the basins of these two rivers, does not coincide with any of the more marked physical features;

and while the bold escarpments of the Millstone Grit and Lower Coal Measure tracts are breached by unimportant brooks, a line of hills, by no means comparable as a whole with these conspicuous ridges, suffices to part the waters of the two most important rivers.

The Millstone Grit tract on the west is characterized by the bold escarpments of its thick and massive sandstones. It is, however, lower than the generality of gritstone districts, and consequently instead of peat mosses, heather, grouse, and mountain sheep, we have enclosed grass lands, the last remnant of handloom sheds, many small manufacturing villages, and single mills. The Kinder Scout Grit peeps up in the bottom of some of the valleys, and above it rise in steps the escarpments of the four sandstone beds, marked A, B, C, D, in the table on p. 4. Above these the bold escarpment of the Rough Rock comes on, from the summit of which the ground falls away gently to the east along the dip-slope of the bed, in an inclined plane, broken into several detached pieces by eastward flowing streams.

From the eastern edge of the incline formed by the dip-slope of the Rough Rock, the ground rises sharply to the summit of a marked ridge which stretches in a straight course across the country, except where it is interrupted by the valleys of the Colne and Calder, or broken through and shifted by faults. On the western flank of this ridge, the different members of the Ganister Coal group (Nos. 13 to 31) crop out in succession. Its summit is formed by the escarpment of the Elland Flagstone.

One important interruption in the trend of this ridge deserves special notice. Between Stainland and Sheepridge is a belt of east and west faults, the general effect of which is a downthrow of the measures to the north, and a consequent shifting of their outcrops westwards. By this dislocation the otherwise continuous flagstone escarpment is broken through and heaved for a distance of nearly two miles. Between these faults the measures change from their usual north and south trend, and strike east and west. North-east of Halifax the flagstone plateau has been cut into by the beautiful Shibden Dale, and the measures below laid open nearly down to the Millstone Grit.

The flagstone escarpment is again broken through by a group of faults south-west of Clayton, near the northern edge of the map; and beyond these it begins to show the east and west strike, which, as already mentioned, sets in in the north-eastern part of the district.

The range formed of the flagstone has a gentle easterly slope, for the most part occupied by wide spreads of that rock, beyond which we pass on to the comparatively tame country occupied by the rest of the Lower Coal Measures and the overlying Middle Coal Measures.

This tract may be conveniently divided for our present purpose into three parts, separated from one another by important faults.

One of the belt of east and west faults already mentioned, ranges on over the country north of Cooper Bridge Station, above Batley Carr, to Hanging Heaton. To the south of this fault we have all the measures up to the Thornhill and Dewsbury Rock, the escarpments of which on Thornhill Edge and Dewsbury Bank somewhat redeem the Middle Coal Measure country from its usual tameness. The fault just mentioned throws down to the north, and just brings in the Haigh Moor Coal and measures above it, about Lower Soothill.

The area underlain by the Haigh Moor Coal, is bounded on the north by a fault, down south, between Soothill Wood and Howley Park, beyond which the Dewsbury Rock again appears in force and is the highest bed in the district.

This tract is bounded on the north by a fault through Tong and Cutler Heights, with a large upthrow to the north-east, by which all the coals above the Beeston Bed are thrown out.

We have, therefore, two areas over which all the measures up to the Dewsbury Rock are found; one small space in which we have in addition the coals up to the Haigh Moor, and a triangular district on the north-east, in which nothing higher than the Beeston Bed occurs.

*Boulder Beds.*—The greater part of the district is free from Drift, and it is not till we cross the watershed between the Aire and Calder valleys that we meet with anything that can with certainty be referred to this formation. Such beds may be seen in Clayton Beck below Clayton, where the boulders are mostly of Millstone Grit with one of Limestone here and there; in the Bradford Valley, where we find clay and gravel containing Trap, Granite, Mountain Limestone, Chert, and other far-travelled stones, as far up as Great Horton and Rooley.

In some places beds, having a strong resemblance to Drift, but containing only fragments of local rocks, are found to the south of the watershed, as at Low Moor and Wibsey Slack, and in and near Chadwick Wood in the valley of the Calder.

Boulders of several kinds of granite, of felspathic trap, and of black limestone, have been found in the bed of the Calder, near Elland. These have most likely been washed out of Drift further to the west.

*River Deposits of the Calder.*—Patches of gravel, in all probability of river formation, are found at Elland Tunnel and Kirklees Park, about 150 feet above the present level of the stream.

Terraces of sand, gravel, and brickearth, also occur from 10 to 12 feet above the present alluvial plain, as at Thornhill Lees.

The modern alluvium stretches in a succession of flats along the course of the river: a thickness of 40 feet of sand and gravel has been proved near Red Laithes. In a cutting in River-gravel near Raven's Wharf, Dewsbury, many very large trees were found at a depth of from 8 to 10 feet, and worked beams of wood, some of which could not have been shaped without the use of a saw.

Geological Survey Office,  
28, Jermyn Street, London, S.W.,  
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